

Application No. 10/708,730
Amendment Dated November 6, 2006
Reply to Office Action of May 5, 2006

Amendments to the Drawings:

The attached sheets of drawings include changes to Figures 1c and 5a. These sheets replace the original sheets including Figures 1c and 5a.

Attachment: Replacement Sheets

REMARKS

Applicants respectfully request further examination and reconsideration in view of the above amendments and the arguments set forth fully below. In the Office Action mailed May 5, 2006, claims 1-8 have been rejected, a new oath and declaration is required, Figures 1c and 5a have been objected to, numerous paragraphs of the specification have been objected to, and claims 1-8 have been objected to. In response, the Applicants have submitted the following remarks, amended the specification, amended claims 1-8, hereby submit a new executed oath and declaration, and amended Figures 1c and 5a. Accordingly, claims 1-8 are still pending. Favorable reconsideration is respectfully requested in view of the amendments and the remarks below.

Oath/Declaration

Within the Office Action, it is stated that a new oath or declaration is required because the S-signatures is improper due to a lack of slashes. In response, the Applicants submit herewith a new oath and declaration that properly identifies the application by application number and filing date according to MPEP §602.01 and 602.02.

Drawings

Within the Office Action, the drawings have been objected to because Figures 1c and 5a are informal and lacking in details. By the above amendments, the Applicants have incorporated the Examiner's suggestions for Figures 1c and 5a. The Applicants respectfully request that the objection to Figures 1c and 5a be withdrawn.

Specification

Within the Office Action, the disclosure has been objected to because of a number of informalities, as well as various grammatical errors throughout the specification. By the above amendments, the Applicants have amended the abstract, as well as paragraphs [0006], [0013], [0016], [0029], [0034], [0037], [0038], [0040], [0042], [0045], [0049],

[0054], [0058], [0060], [0061], and [0069], and deleted paragraphs [0039], [0046] and [0062] in order to remedy the informalities and grammatical errors. The Applicants respectfully request the Examiner to withdraw the objection to the specification accordingly.

Claim Objections

Claims 1-8 have been objected to because of a number of informalities and grammatical errors, as outlined in the Office Action. By the above amendments, the Applicants have amended claims 1-8 to remedy all of the informalities and grammatical errors. Accordingly, the Applicants respectfully request that the Examiner withdraw the objections to claims 1-8.

Rejections Under 35 U.S.C. §102

Claim 7 has been rejected under 35 U.S.C. §102(a) as being anticipated by the prior art reference in the Applicants' disclosure.

By the above amendment, the Applicants have amended claim 7 to include a compact curve grating suitable for analyzing the spectra composition of an optical beam, the optical beam being incident on the compact curved grating via an entrance slit, the analyzed optical beam from the compact curved grating being incident on a detector, the compact curved grating comprising a plurality of grooves, the distance between the grooves being dependent on the location of the entrance slit and the detector, the center operation wavelength, a diffraction order, the refractive index of the medium and on the location of the adjacent grooves, such that a path difference between two adjacent grooves is an integral of the center of operation wavelength, wherein an arc length of each of the grooves is the same. The Applicants respectfully submit that the Applicants' admitted prior art does not teach a path difference between two adjacent grooves being an integral of the center of operation wavelength, and wherein an arc length of each of the

grooves is the same. For at least these reasons, the Applicants respectfully submit that claim 7 is allowable over the teachings of the prior art.

Rejections Under 35 U.S.C. §103

Claims 1-4 have been rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,114,231 to Gautherin et al. (hereinafter Gautherin) in view of U.S. Patent No. 4,380,393 to Nagata et al. (hereinafter Nagata), and further in view of the Applicants' disclosure.

Gautherin teaches a spectroscopic analysis device having a light source, light analyzer comprising an entrance slit, diffraction grating and at least one exit slit which are disposed along a roll and circle, and an optical transmission system (Gautherin, abstract). Gautherin does not teach a curved grating having a plurality of grooves such that a path difference between two adjacent grooves is an integral of the center of operation wavelength, and wherein an arc length of each of the grooves is the same.

Nagata teaches a grazing incidents spectrometer having an entrance slit in a diffraction grating for diffracting the light rays incident thereon from the entrance slit and for imaging the light rays as a plurality of spectro-lines (Nagata, abstract). Likewise, Nagata does not teach a curved grating comprising a plurality of grooves such a path difference between the two adjacent grooves is an integral of the center of operation wavelength, and wherein an arc length of each of the grooves is the same.

In contrast to the teachings of Gautherin and Nagata, the spectrometer of the present invention includes a curved grating having a plurality of grooves such that the location of the grooves are obtained by two conditions. The first condition is that the path difference between a set of any adjacent grooves is an integral multiple of the wavelength in the medium. This first condition mathematically expressed in the specification in paragraph [0038]. The second condition for the location of the plurality of grooves is specific for a particular design goal of the curve grating spectrometer. Furthermore, as is discussed in paragraph [0060] and [0061] of the specification, the arc lengths of all of the

grooves are the same throughout the curved grating, and is expressed mathematically in paragraph [0061]. As discussed above, neither Gautherin nor Nagata, nor their combination teach these features of the present invention.

The independent claim 1 is directed to a spectrometer suitable for analyzing a spectra composition of an optical beam, the spectrometer enabling a detection of light of a particular wavelength, the spectrometer comprising an entrance slit for allowing an entry of the optical beam into the spectrometer, a location of the entrance slit being adjustable for controlling a performance of the spectrometer, a detector for detecting the optical beam, a location of the detector being adjustable for controlling a performance of the spectrometer, and a curved grating for analyzing the spectra composition of the optical beam, the curved grating comprising a plurality of grooves, a distance between the grooves being dependent on the location of the entrance slit and the detector, a center of operation wavelength, the diffraction order, a refractive index of the medium and on the location of the adjacent grooves, such that a path difference between two adjacent grooves is an integral of the center of operation wavelength, wherein an arc length of each of the grooves is the same. As discussed above, neither Gautherin, Nagata, nor their combination teach a curved grating having a plurality of grooves, such that a path difference between adjacent grooves is an integral of the center of operation wavelength, wherein the arc length of each of the grooves is the same. For at least these reasons, the independent claim 1 is allowable over the teachings of Gautherin, Nagata, Applicants' disclosure and their combination.

Claims 2-4 are dependent upon the independent claim 1. As discussed above, the independent claim 1 is allowable over the teachings of Gautherin, Nagata, Applicants' disclosure, and their combination. Accordingly, claims 2-4 are also allowable as being dependent upon an allowable base claim.

Claim 5 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Gautherin in view of Nagata and the Applicants' disclosure, and further in view of U.S. Patent No. 6,339,662 Koteles et al. (hereinafter Koteles). Claim 5 is dependent upon the

independent claim 1. As discussed above, the independent claim 1 is allowable over the teachings of Gautherin, Nagata, Applicants' disclosure, and their combination. Accordingly, claim 5 is also allowable as being dependent upon an allowable base claim.

Claim 8 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Gautherin in view of Nagata and Applicants' disclosure, and in further view of U.S. Patent No. 4,820,046 Sohma et al. (hereinafter Sohma).

Sohma teaches a spectroscope apparatus and reaction apparatus using the same including means for separating light from an object to be measured into spectro-components, means for mixing that part of the spectro-components which exists in the desired wavelength range, and means for forming an image of the to be measured body of mixed light (Sohma, abstract). Sohma does not teach determining positions of grooves in a curved grating by insuring the path difference between adjacent grooves is an integral multiple wavelength in the medium, according to the following mathematical expression: $[d_1(\theta_1, S_1, X_i) + d_2(\theta_2, S_2, X_i)] - [d_1(\theta_1, S_1, X_{i-1}) + d_2(\theta_2, S_2, X_{i-1})] = m\lambda/n$, wherein $d_1(\theta_1, S_1, X_i)$ is a distance from one of the plurality of grooves located at X_i from the entrance slit, $d_2(\theta_2, S_2, X_i)$ is a distance from one of the plurality of grooves from the detector, m is a diffraction order and n is a refractive index of the medium, and further wherein an arc length of each of the grooves is the same. Sohma further does not teach an arc length of each of the grooves being the same.

The independent claim 8 is directed to A method for analyzing a spectra composition of an optical beam, the method comprising adjusting a location of an entrance slit in order to have best performance at a particular design goal, the optical beam entering the spectrometer through the entrance slit, adjusting a location of a detector in order to have best performance at a particular design goal, the spectra composition of the optical beam being detected by the detector, and using a compact curve grating in order to analyze the spectra composition of the optical beam, the compact curved grating comprising a plurality of grooves, the step of using the compact curved grating further comprising the step of: calculating initial groove spacing using the information relating to

location of the entrance slit and the detector, center of the operation wavelength, refractive index of the medium and the diffraction order, and determining the positions of other grooves, the position being determined by ensuring that path difference between adjacent grooves is an integral multiple of the wavelength in the medium, according to the following mathematical expression:

$[d_1(\theta_1, S_1, X_i) + d_2(\theta_2, S_2, X_i)] - [d_1(\theta_1, S_1, X_{i-1}) + d_2(\theta_2, S_2, X_{i-1})] = m\lambda/n$, wherein $d_1(\theta_1, S_1, X_i)$ is a distance from one of the plurality of grooves located at X_i from the entrance slit, $d_2(\theta_2, S_2, X_i)$ is a distance from one of the plurality of grooves from the detector, m is a diffraction order and n is a refractive index of the medium, and further wherein an arc length of each of the grooves is the same. As discussed above, neither Gautherin, Nagata, Applicants' disclosure, nor Sohma, nor their combination teach determining the positions of a plurality grooves on a compact curve grating by insuring that the path difference between adjacent grooves is an integral multiple of the wavelength in the medium, according to the following mathematical equation:

$[d_1(\theta_1, S_1, X_i) + d_2(\theta_2, S_2, X_i)] - [d_1(\theta_1, S_1, X_{i-1}) + d_2(\theta_2, S_2, X_{i-1})] = m\lambda/n$, wherein $d_1(\theta_1, S_1, X_i)$ is a distance from one of the plurality of grooves located at X_i from the entrance slit, $d_2(\theta_2, S_2, X_i)$ is a distance from one of the plurality of grooves from the detector, m is a diffraction order and n is a refractive index of the medium, and further wherein an arc length of each of the grooves is the same, nor that an arc length of each of the grooves is the same. For at least these reasons, the independent claim 8 is allowable over the teachings of Gautherin, Nagata, Applicants' disclosure, Sohma and their combination.

Furthermore, where the Examiner relies on three, four or more references in a support of a single rejection, the multiplicity of references supports Applicants' assertion of non-obviousness, because even with knowledge of the Applicants' structure the Examiner had to rely on not one, or two or three, but four references and pick and choosing among the features of those references to come up with the elements of the claimed invention. But for the knowledge of Applicants' disclosure, gleaned from reading the application, it is not likely that the Examiner or another skilled in the art,

would have thought of picking one part from one reference, one part from another, one part from another, and still more from another. None skilled in the art, so far as the patents cited by the Examiner are concerned, thought of making this combination, as evidence by the multiplicity of references that are necessary to make the rejection.

The Applicants also respectfully submit that the age of the cited references indicates a lack of some teaching or suggestion supporting the combination. The Nagata patent was filed on March 26, 1981, the Sohma patent was filed on November 12, 1987, and the Gautherin patent was filed on September 5, 1990. Even with the benefit of the filing date that is over six years later than Nagata, Sohma still does not include some teaching or suggestion that the art taught in each reference can and should be combined. Furthermore, even with the benefit of a filing date that is almost three years later than Sohma, Gautherin does not include some teaching or suggestion that the art taught in each reference can and should be combined. In other words, there is no teaching or suggestion in any of the references to make the combination made in the Office Action.

Furthermore, the Nagata patent issued on April 19, 1983, the Sohma patent issued on April 11, 1989, and the Gautherin patent issued on May 19, 1992. The present application was filed on March 20, 2004, almost twelve years after Gautherin issued, almost fifteen years after Sohma issued, and almost twenty years after Nagata issued. The Applicants respectfully submit that if the combination of the cited references was indeed obvious, as is stated in the Office Action, then it is probable that such a combination would have been made prior to the filing of the present application. Therefore, the Applicants submit that this combination of references is indeed not obvious.

Within the Office Action, regarding claim 6, it is stated that a recitation with respect to the manner in which a claimed apparatus intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. By the above amendment, the Applicants have amended claim 6 to remedy this rejection. Claim 6 is furthermore dependent upon the independent claim 1.

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As discussed above, the independent claim 1 is allowable over the teachings of Gautherin, Nagata, Applicants' disclosure and their combination. For at least these reasons the reasons, claim 6 is also allowable as being dependent upon an allowable base claim.

For these reasons, Applicants respectfully submit that all of the claims are now in a condition for allowance, and allowance at an early date would be appreciated. Should the Examiner have any questions or comments, they are encouraged to call the undersigned at 414-271-7590 to discuss the same so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,

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